

APPENDIX G

Geology

**UPDATE
GEOTECHNICAL REPORT**

**OTAY RANCH VILLAGE 2
SPA PLAN AMENDMENT
CHULA VISTA, CALIFORNIA**



GEOCON
INCORPORATED

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

PREPARED FOR

**BALDWIN & SONS INCORPORATED
SAN DIEGO, CALIFORNIA**

**FEBRUARY 10, 2014
PROJECT NO. 06862-52-30**



Project No. 06862-52-30
February 10, 2014

Baldwin & Sons Incorporated
610 West Ash Street, Suite 1500
San Diego, California 92101

Attention: Mr. Nick Lee

Subject: UPDATE GEOTECHNICAL REPORT
OTAY RANCH VILLAGE 2
SPA PLAN AMENDMENT
CHULA VISTA, CALIFORNIA

Dear Mr. Lee:

In accordance with your authorization of our proposal dated September 17, 2010 (LG-10243) and Change Order dated February 18, 2011, we have prepared an update geotechnical report for the subject project. The accompanying report presents the findings of our study and our recommendations relative to the geotechnical aspects of developing the property as presently proposed. Based on the results of our update report, it is our opinion that the site can be developed as planned, provided the recommendations of this report are followed.

Should you have any questions regarding this report, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED


Shawn Foy Weedon
GE 2714




John Hoobs
CEG 1524



SFW:JH:dmc

(4/del) Addressee

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UPDATE GEOTECHNICAL REPORT

1. PURPOSE AND SCOPE

This report presents the results of an update geotechnical study for the proposed Otay Ranch Village 2 SPA plan amendment. The project is located in the eastern portion of Chula Vista, California. The purpose of the report was to provide an update to the existing subsurface soil and geologic conditions at the site for use in submittals for the plan amendment. We understand the Village 2 site is and will continue to be developed for single- and multi-family residential homes, commercial and retail, apartments, schools, and parks.

We reviewed the following reports and plans to prepare this geotechnical report:

1. *Geotechnical Investigation, Otay Ranch Village 2 East, Heritage Road, and Village 4 Community Park, Chula Vista, California*, prepared by Geocon Incorporated, dated February 14, 2006 (Project No. 06862-52-02).
2. *Geotechnical Investigation, Otay Ranch Village 2 West, Chula Vista, California*, prepared by Geocon Incorporated, dated October 20, 2006 (Project No. 06862-52-09).
3. *Final Report of Testing and Observation Services Performed During Site Grading, Otay Ranch, Village 2, Heritage Road from Olympic Parkway to Heritage Road Station 87+88, Chula Vista, California*, prepared by Geocon Incorporated, dated June 18, 2007 (Project No. 06862-52-12).
4. *Interim Report of Testing and Observation Services Performed During Site Grading, Otay Ranch, Village 2, North, Units 1 and 2, Chula Vista, California*, prepared by Geocon Incorporated, dated August 28, 2007 (Project No. 06862-52-13).
5. *Interim Report of Testing and Observation Services Performed During Site Grading, Otay Ranch, Village 2, Phase 1, Chula Vista, California*, prepared by Geocon Incorporated, dated April 26, 2012 (Project No. 06862-52-02C).
6. *Tentative Map, Otay Ranch, Village 2, City of Chula Vista, California*, prepared by Hunsaker & Associates, 2012.
7. *Rough Grading Plan, Otay Ranch Village 2, Heritage Road, From Olympic Parkway to Sta. 87+88, Chula Vista tract No. 06-05*, prepared by Hunsaker & Associates, dated September 25, 2006.

2. SITE AND PROJECT DESCRIPTION

The Otay Ranch Village 2 development is located south of Olympic Parkway, north and east of the Otay Landfill, and west and east of proposed Heritage Road in the City of Chula Vista, California. The West portion of the property bounded on the north by Olympic Parkway and the Poggi Creek drainage channel, on the east by Heritage Road, on the west by undeveloped land, and on the south

by the Otay Landfill. The East portion of the property located south of Olympic Parkway and Otay High School, west of La Media, north of Otay Village 3 and 4, and east of the Otay Landfill and Heritage Road. The approximate location of Otay Village 2 is shown on the Vicinity Map, Figure 1.

Otay Ranch Village 2 consists of canyon and ridge topography with several gently sloping to steep-walled canyons. Drainage on the site flows both north and south from an east - west ridgeline along the central portion of the site. Drainage on the West area flows toward a central valley which flows into the drainage structures along the Poggi Creek drainage channel on the south side of Olympic Parkway. Drainage on the East area flows to the north toward Poggi Canyon and south toward Otay River. The construction of Olympic Parkway has resulted in several improvements to the West property along the northern project boundary, including utilities, drainage devices, and buttressed cut slopes. The construction of numerous improvements on the East property has occurred due to several developers constructing residential homes, multi-family, and apartments with associated roadway improvements. The Otay 2nd Pipeline and Tunnel exists on the East property and traverses on the eastern and northeastern portions of the site.

A review of the referenced plans indicates that existing and proposed slopes for Village 2 have heights up to 120 feet high with inclinations of 2:1 (horizontal to vertical), or less. Existing and proposed buttressed cut slopes up to approximately 150 feet high exist or will be constructed.

The locations and descriptions herein are based on a site reconnaissance and review of the referenced plans. If final development plans differ significantly from those described herein, Geocon Incorporated should be contacted for review and possible revisions to this report.

3. GEOLOGIC SETTING

The site is located in the coastal plain of the Peninsular Ranges province of southern California. The Peninsular Ranges is a geologic and geomorphic province that extends from the Imperial Valley to the Pacific Ocean and from the Transverse Ranges to the north and into Baja California to the south. The coastal plain of San Diego County is underlain by a thick sequence of relatively undisturbed and non-conformable sedimentary rocks that range in age from Upper Cretaceous through the Pleistocene with intermittent deposition. Geomorphically, the coastal plain is characterized by a stair-stepped series of marine terraces, which are younger to the west and have been dissected by west flowing rivers that drain the Peninsular Ranges to the east. The coastal plain is a relatively stable block that is dissected by relatively few faults consisting of the potentially active La Nacion Fault Zone and the active Rose Canyon Fault Zone. The Peninsular Ranges are also dissected by the Elsinore Fault Zone that is associated with and sub-parallel to the San Andreas Fault Zone, which is the plate boundary between the Pacific and North American Plates.

The site is located on the eastern portion of the coastal plain. Marine sedimentary units make up the geologic units encountered on the site and consist of a Quaternary-age Terrace Deposits, Pliocene- and Pleistocene-age San Diego Formation, and the Tertiary age Otay Formation. The Terrace Deposits cap the top of the highest ridges on the site and consist of reddish brown silty sandstone. The San Diego Formation unconformably underlies the Terrace Deposits and consists of yellowish brown, silty sandstone. The Otay Formation unconformably underlies the San Diego Formation and typically consists of three lithostratigraphic members composed of a basal conglomerate member, a middle gritstone member and an upper sandstone/siltstone/claystone member with a maximum reported regional thickness of roughly 400 feet. The upper two members of the Otay Formation are present on the site. In addition, bentonitic claystone and siltstone layers are common within the upper member typically deposited as highly consolidated volcanic ash deposits. The thickness of the Otay Formation is in excess of 350 feet on the site.

4. SOIL AND GEOLOGIC CONDITIONS

4.1 General

Five surficial soil types and three geologic formations were encountered during our investigation. The surficial units consist of undocumented fill, previously placed fill, topsoil, alluvium, colluvium, and landslide debris. Formational units include Quaternary-age Terrace Deposits, Pliocene and Pleistocene-age San Diego Formation, and the Tertiary-age Otay Formation. The formational and surficial units are discussed below in order of increasing age. The approximate lateral extent of the formational and surficial soil units is presented on the Geologic Map, Figure 2 (map pocket).

4.2 Undocumented Fill (Qudf)

Undocumented fill has been placed within the southern portion of the project. The undocumented fill is associated with stockpiling operations of soil generated during construction operations and stockpiling of construction debris. These fill units are not considered suitable for support and development of proposed improvements and remedial grading will be required.

4.3 Previously Placed and Compacted Fill (Qcf and Qpf₁ – Qpf₄)

Compacted fill associated with five previous phases of grading is present in numerous areas within the East portion of the project. In general, previously placed fill consists of sand, silt, and clay derived from on-site excavations. The fill was placed during the filling of previous canyon drainages, buttress fill areas, and within undercut pad and street areas. These fill units are considered suitable for support and development of proposed improvements.

4.4 Topsoil (Unmapped)

Topsoil is present as a thin veneer overlying formational materials across the ungraded portions of the site. The topsoil has an average thickness of approximately 3 feet and is characterized as soft to stiff and loose to medium dense, dry to damp, dark brown, sandy clay to clayey sand. The clayey portion of the topsoil is typically expansive and compressible. Removal of the topsoil will be necessary in areas to support fill or structures. Due to the relatively thin thickness, topsoil is not shown on the Geologic Map.

4.5 Alluvium (Qal)

Alluvium is stream-deposited material found in the natural canyon drainages and generally varies in thickness dependent upon the size of the canyon. The alluvium consists of firm to stiff, dry to moist, light to dark brown, sandy clay and loose to medium dense, damp to moist, silty to clayey sand. The thickness of alluvium can be more than 15 feet thick in the larger canyon drainages. Due to the relatively unconsolidated nature of the alluvial deposits, remedial grading will be necessary in areas to receive fill or structures.

4.6 Colluvium (Unmapped)

Colluvium derived from formational materials at higher elevations is present on the side slopes of natural canyons and the upper portions of the canyon drainages. The colluvium consists of stiff to hard, dry to moist, light to dark brown, sandy clay and loose to medium dense, clayey to silty sand. The thickness of colluvium generally ranges from approximately 2 to 6 feet, but can be considerably thicker within the landslide debris. Removal of the colluvium is required in areas that will support fill or structures. Due to the relatively thin thickness and discontinuity of the deposits, colluvium is not shown on the Geologic Map.

4.7 Landslide Debris (Qls)

Five areas of landslide debris exist within the site. Four slide areas are located in the West portion of the property and one within the southwest corner of the East portion. The landslide debris varied from a few feet thick at the toes of the landslide to as much as 70 feet thick. The base of the slide mass is typically coincident with a bentonitic claystone bed. The landslides generally consist of a loose, upper portion, typically 10 to 15 feet thick, a graben zone of variable thickness typically backfilled with colluvium, a medium dense to dense core zone composed of tightly fractured Otay Formation, and a landslide toe composed of loose debris. Seepage conditions were encountered in several of the borings excavated into landslide debris. Landslide debris will either be completely or partially removed during future grading depending on proposed finish grade configurations and adjacent property constraints.

The upper portions of landslide debris, colluvium, and landslide toe debris are potentially compressible and will require remedial grading in the form of removal and compaction within areas of proposed development. The medium dense to dense landslide core zone is suitable for the support of compacted fill and can be left in-place as shown on the geologic map. Three landslides are proposed to be removed during remedial grading and two landslides will have a partial removal. Several planned cut slopes are underlain by landslide debris and slope buttresses or stabilization fills will be necessary.

4.8 Terrace Deposits (Qt)

Quaternary-age Terrace Deposits, formerly mapped as Lindavista Formation, unconformably overlie the San Diego Formation on the mesa tops generally above approximate elevation 450 to 470 MSL. Sediments generally associated with this formation consist of cobble-gravel-sand mixtures with locally cemented zones and sandy to clayey siltstones. The granular soil of the Terrace Deposits typically exhibit adequate shear strength and low expansive potential in either an undisturbed or properly compacted condition. The Terrace Deposits are generally suitable for the support of compacted fill and structural loads.

4.9 San Diego Formation (Tsd)

The Tertiary-age San Diego Formation overlies the Otay Formation and typically consists of yellowish to olive brown, massively bedded to locally cross-bedded, fine- to coarse-grained sandstones with some cemented gravel lenses. The San Diego Formation in the Chula Vista area overlies the upper member of the Otay Formation and underlies the Terrace Deposits. Cohesionless, friable sand lenses can also occur within the San Diego Formation and may require remedial grading measures if encountered in proposed cut slopes or at finish-pad grade during grading operations. In general, the sediments of the San Diego Formation exhibit adequate shear strength and “very low” to “medium” expansion characteristics in either an undisturbed or properly compacted condition. The San Diego Formation is suitable for the support of compacted fill and structural loads. Oversize material may be generated in this unit during grading because of matrix cementation.

4.10 Otay Formation (To)

The Tertiary-age (upper Oligocene) Otay Formation underlies the site on canyon slopes or underlying the younger geologic formations and surficial soil at depth. The Otay Formation consists of dense, silty, fine- to coarse-grained sandstone, clayey and sandy siltstone, and silty claystone with continuous and discontinuous interbeds of highly expansive bentonitic claystone. The coarse-grained portions of the Otay Formation typically possess a “very low” to “low” expansion potential and adequate shear strength. The siltstone and claystone portions of the formation can exhibit a “medium” to “very high” expansion potential. With the exception of the bentonitic claystone, the Otay Formation is suitable for the support of compacted fill and structural loads.

Laterally extensive beds of bentonite claystone exist throughout the site with a variable thickness of less than 1 foot to a maximum of 9 feet. These bentonite layers have been mapped as underlying the majority of Otay Ranch and its occurrence is well documented in the geologic literature (Cleveland, 1960). The bentonitic claystone beds consist of very expansive clays, which typically exhibit low shear strength. As previously mentioned, the bentonite claystone layers contain the failure surfaces of the landslides encountered at the site. Down-hole observations within several large-diameter borings indicate the presence of remolded clay seams along gently dipping bedding planes within the bentonitic claystone layers. These “bedding plane shear” features are common in these layers and are interpreted to be primarily due to compressional and tensional forces created during tectonic deformation that resulted in large-scale gentle folding in the formational units. An “intraformational landslide” feature was observed within the Otay Formation underlying the eastern slopes of the Heritage Road alignment, within the slopes along the north side of Santa Victoria Road and along the slopes on the northern margin of the site. The “intraformational landslide” deposits are generally medium dense to dense and possess low compressibility characteristics. This feature was observed to contain sheared claystone beds with shallow to moderate dip orientations which may contribute to slope instability if exposed in cut slopes.

Several discontinuous interbeds of bentonitic claystone also exist within the upper portion of the Otay Formation and the location of these layers is difficult to predict. The bentonitic claystone will require special consideration with respect to placement and mixing as fill, undercutting of pad and street subgrade, and buttress slope stability. Discontinuous claystone layers encountered during grading should be evaluated in the field on an individual basis.

The lower portion (middle member) of the Otay Formation consists of dense, tan, gravelly, fine- to coarse-grained sandstone that is locally well cemented. This unit has been informally named the “gritstone” unit on the excavation logs. This member is generally found stratigraphically below the bentonitic claystone layer and extends to the lowest elevations explored during our subsurface investigation. Excavations and slopes constructed in the “gritstone” portions of the Otay Formation are expected to be relatively stable and typically have a “very low” to “low” expansion potential.

5. GEOLOGIC STRUCTURE

Bedding attitudes observed within formational materials encountered during the investigation are nearly horizontal to slightly dipping toward the southwest. The regional dip of sedimentary units in the eastern Chula Vista area is generally 1 to 5 degrees toward the southwest. The granular portions of the formational units are typically massive with bedding not discernible. Sheared claystone beds were encountered within the “intraformational landslide” areas of the Otay Formation with dips generally between 10 and 20 degrees toward the west or north. The “intraformational landslide” unit has been incorporated into the Otay Formation for the purposes of this study. Shear zones create a possibility for slope instability and, where encountered during grading, should be evaluated for the

necessity of remedial grading. High-angle contacts between formational units are not uncommon; however, it is our opinion that adverse geologic structure does not present a significant geologic hazard to the proposed development of the site if the recommendations of this report are incorporated into design and construction.

6. GROUNDWATER

We did not encounter a static groundwater table in the previous exploratory excavations and during the grading operations. We do not expect groundwater to adversely impact the development of the property. Groundwater seepage was encountered locally in the landslide debris at the time of excavation. It is not uncommon for groundwater seepage conditions to develop where none previously existed due to the permeability characteristics of the geologic units encountered on site. During the rainy season, perched water conditions are likely to develop within the drainage areas that may require special consideration during grading operations. Groundwater elevations are dependent on seasonal precipitation, irrigation, and land use, among other factors, and vary as a result.

7. GEOLOGIC HAZARDS

7.1 Seismicity – Deterministic Analysis

According to the computer program *EZ-FRISK (Version 7.62)*, six known active faults are located within a search radius of 50 miles from the property. We used the 2008 USGS fault database that provides several models and combinations of fault data to evaluate the fault information. Based on this database, the Newport-Inglewood and Rose Canyon Fault Zones, located approximately 9 miles northwest of the site, are the nearest known active faults and are the dominant source of potential ground motion. Earthquakes that might occur on the Newport-Inglewood and Rose Canyon Fault Zones or other faults within the southern California and northern Baja California area are potential generators of significant ground motion at the site. The estimated maximum earthquake magnitude and peak ground acceleration for the Newport-Inglewood Fault are 7.5 and 0.30g, respectively. Table 7.1.1 lists the estimated maximum earthquake magnitude and peak ground acceleration for the most dominant faults in relation to the site location. We calculated peak ground acceleration (PGA) using Boore-Atkinson (2008) NGA USGS2008, Campbell-Bozorgnia (2008) NGA USGS 2008, and Chiou-Youngs (2007) NGA USGS2008 acceleration-attenuation relationships.

TABLE 7.1.1
DETERMINISTIC SPECTRA SITE PARAMETERS

Fault Name	Distance from Site (miles)	Maximum Earthquake Magnitude (Mw)	Peak Ground Acceleration		
			Boore-Atkinson 2008 (g)	Campbell-Bozorgnia 2008 (g)	Chiou-Youngs 2008 (g)
Newport-Inglewood	9	7.5	0.28	0.23	0.30
Rose Canyon	9	6.9	0.24	0.21	0.24
Coronado Bank	18	7.4	0.20	0.15	0.18
Palos Verdes Connected	18	7.7	0.22	0.16	0.20
Elsinore	41	7.9	0.14	0.09	0.11
Earthquake Valley	45	6.8	0.08	0.06	0.05

In the event of a major earthquake on the referenced faults or other significant faults in the southern California and northern Baja California area, the site could be subjected to moderate to severe ground shaking. With respect to this hazard, the site is considered comparable to others in the general vicinity.

We performed a site-specific probabilistic seismic hazard analysis using the computer program *EZ-FRISK*. Geologic parameters not addressed in the deterministic analysis are included in this analysis. The program operates under the assumption that the occurrence rate of earthquakes on each mapped Quaternary fault is proportional to the faults slip rate. The program accounts for fault rupture length as a function of earthquake magnitude, and site acceleration estimates are made using the earthquake magnitude and distance from the site to the rupture zone. The program also accounts for uncertainty in each of following: (1) earthquake magnitude, (2) rupture length for a given magnitude, (3) location of the rupture zone, (4) maximum possible magnitude of a given earthquake, and (5) acceleration at the site from a given earthquake along each fault. By calculating the expected accelerations from considered earthquake sources, the program calculates the total average annual expected number of occurrences of site acceleration greater than a specified value. We utilized acceleration-attenuation relationships suggested by Boore-Atkinson (2008) NGA USGS2008, Campbell-Bozorgnia (2008) NGA USGS 2008, and Chiou-Youngs (2007) NGA USGS2008 in the analysis. Table 7.1.2 presents the site-specific probabilistic seismic hazard parameters including acceleration-attenuation relationships and the probability of exceedence.

**TABLE 7.1.2
PROBABILISTIC SEISMIC HAZARD PARAMETERS**

Probability of Exceedence	Peak Ground Acceleration		
	Boore-Atkinson, 2008 (g)	Campbell-Bozorgnia, 2008 (g)	Chiou-Youngs, 2008 (g)
2% in a 50 Year Period	0.44	0.36	0.41
5% in a 50 Year Period	0.32	0.27	0.29
10% in a 50 Year Period	0.24	0.21	0.22

The California Geologic Survey (CGS) has a program that calculates the ground motion for a 10 percent of probability of exceedence in a 50-year period based on an average of several attenuation relationships. Table 7.1.3 presents the calculated results from the Probabilistic Seismic Hazards Mapping Ground Motion Page from the CGS website.

**TABLE 7.1.3
PROBABILISTIC SITE PARAMETERS FOR SELECTED FAULTS
CALIFORNIA GEOLOGIC SURVEY**

Calculated Acceleration (g) Firm Rock	Calculated Acceleration (g) Soft Rock	Calculated Acceleration (g) Alluvium
0.22	0.24	0.28

While listing peak accelerations is useful for comparison of potential effects of fault activity in a region, other considerations are important in seismic design, including the frequency and duration of motion and the soil conditions underlying the site. Seismic design of the structures should be performed in accordance with the 2010 California Building Code (CBC) guidelines currently adopted by the city of Chula Vista.

7.2 Liquefaction

Liquefaction typically occurs when a site is subjected to strong seismic shaking, on-site soils are cohesionless, groundwater is encountered within 50 feet of the surface, and soil relative densities are less than about 70 percent. If all four previous criteria are met, a seismic event could result in a rapid pore water pressure increase from the earthquake-generated ground accelerations. The potential for liquefaction is considered to be very low due to the dense formational units encountered and the absence of a permanent groundwater table in the upper 50 feet.

7.3 Landsliding

Based on our field reconnaissance and our subsurface investigation, five areas of landslide deposits exist at the site. The approximate limits and dimensions of the landslides are depicted on the Geologic Map, Figure 2. It is the opinion of Geocon Incorporated that the potential for future landsliding adversely affecting the proposed improvements is low, provided the recommendations for removal and compaction of landslide debris and for stabilization of proposed cut slopes are followed.

7.4 Expansive Soil

The formational units will likely possess a “very low” to “medium” expansion potential (Expansion Index [EI] of 90 or less). Localized areas of the formational materials do possess a “high” expansion potential (EI of 91 to 130). However, the bentonitic claystone and siltstone will contain a “high” to “very high” expansive potential (Expansion Index of 91 to over 130). The colluvium, topsoil and alluvium will contain a “medium” to “high” expansive potential (Expansion Index of 51 to 130). We expect proposed grading will expose bentonitic claystone and siltstone beds within cut slopes and buttress fills will be required to stabilize these slopes.

7.5 Tsunamis and Seiches

A tsunami is a series of long period waves generated in the ocean by a sudden displacement of large volumes of water. Causes of tsunamis include underwater earthquakes, volcanic eruptions, or offshore slope failures. The first order driving force for locally generated tsunamis offshore southern California is expected to be tectonic deformation from large earthquakes (Legg, *et al.*, 2002). The County of San Diego Hazard Mitigation Plan (2004) maps zones of high risk for tsunami run-up for coastal areas throughout the county. The site is not included within one of these high-risk hazard areas. The site is approximately 7 miles from the Pacific Ocean. Therefore, we consider the risk associated with tsunamis to be negligible.

A seiche is a run-up of water within a lake or embayment triggered by fault- or landslide-induced ground displacement. The site is not located downstream of a large body of water. Therefore, the potential of seiches affecting the site is considered very low.

8. CONCLUSIONS AND RECOMMENDATIONS

8.1 General

- 8.1.1 No soil or geologic conditions were encountered that would preclude the continued development of the property provided recommendations provided within individual update reports are followed.
- 8.1.2 The surficial soil consisting of topsoil, colluvium, alluvium, and the compressible portions of the landslide debris are not considered suitable for the support of fill or structural loads in their present condition and will require remedial grading in the form of removal, moisture conditioning as necessary, and compaction. Previously placed and compacted fill, the core portions of the landslide debris, Terrace Deposits, and formational materials of the San Diego and Otay Formations are suitable for the support of structures and compacted fill and improvements.
- 8.1.3 Five areas of landslide debris exist on the property. The compressible portions of the landslide debris should be removed and replaced with compacted fill in areas of planned improvements. The dense landslide core may be left in-place. Three of the five landslides will be removed entirely during remedial grading and two landslides will have a partial removal.
- 8.1.4 Where the bentonite layers do not affect the stability of the slopes, cut slopes composed of Terrace Deposits, formational materials, and properly compacted fill, should be grossly stable at inclinations of 2:1 (horizontal:vertical), or less. Potentially unstable cut slopes exposing bentonite clay layers, cohesionless sands, and out-of-slope bedding should be evaluated during grading operations.
- 8.1.5 The presence of relatively thick layers of bentonitic claystone will require special consideration with respect to placement as fill, undercutting of pad and street subgrade, and buttress slope stability. Recommendations for the excavation and placement of bentonitic clays are presented in the referenced reports.

8.2 Soil and Excavation Characteristics

- 8.2.1 Based on the results of the field investigations and our experience in the general area, we expect the surficial soil and formational materials can generally be excavated with moderate to heavy effort using conventional heavy-duty excavation equipment. Cemented zones requiring very heavy effort to excavate may be encountered at random locations in the formational materials; however, the extent is expected to be localized. Difficult ripping

conditions and the generation of oversize material should be expected within these cemented zones. Cemented zones and concretions may be present in cut pads where shallow utilities or building footings are planned.

8.2.2 A majority of the on-site materials possess a “very low” to “medium” expansion potential (expansion index of 90 or less) as defined by the 2010 California Building Code (CBC) Section 1803.5.3. The expansion potential of the bentonite claystone and surficial soil ranges from “high” to “very high” (expansion index greater than 90). Due to the wide range of expansion potential typically exhibited by the Otay Formation, the expansion potential should be evaluated for the building pads once final grade is achieved. The undercutting of cut lots within the Otay Formation may also be necessary.

8.2.3 The soils that will be encountered on the site indicate that concrete structures exposed to soil have a “negligible” water soluble sulfate exposure as defined in the 2010 CBC Section 1904.3 and ACI 318. Laboratory testing should be performed on soil that is exposed at finish grade to determine the percentage of water-soluble sulfate present.

8.3 Subdrains

8.3.1 The geologic units encountered on the site have permeability characteristics and/or fracture systems that could be susceptible under certain conditions to groundwater seepage. The locations of proposed canyon and existing subdrains are presented on the Geologic Map. The use of canyon subdrains will be necessary to mitigate the potential for adverse impacts associated with seepage conditions. Subdrains with lengths in excess of 750 feet or extensions of existing offsite subdrains should use 8-inch-diameter pipes. Subdrains less than 750 feet long should use 6-inch-diameter pipes. Subdrains from minor canyons should be connected to the major canyon subdrain at their intersection point. Subdrains within the buttress and stability fill keyways should use 4-inch-diameter pipes.

8.3.2 Prior to outletting, the final 20-foot segment of subdrain that will not be extended during future development should consist of non-perforated drainpipe. At the non-perforated/perforated interface, a seepage cutoff wall should be constructed on the downslope side of the junction. Subdrains that discharge into a natural drainage course or open space area should be provided with a permanent headwall structure.

8.3.3 The final grading plans should show the location of all proposed subdrains. Upon completion of remedial excavations and subdrain installation, the project civil engineer should survey the drain locations and prepare an “as-built” map depicting the existing conditions. The final outlet and connection locations should be determined during grading.

Subdrains that will be extended on adjacent projects can be placed on formational material and a vertical riser should be placed at the end of the subdrain.

8.4 Site Drainage and Moisture Protection

- 8.4.1 Adequate site drainage is critical to reduce the potential for differential soil movement, erosion and subsurface seepage. Under no circumstances should water be allowed to pond adjacent to footings. The site should be graded and maintained such that surface drainage is directed away from structures in accordance with 2010 CBC 1804.3 or other applicable standards. In addition, surface drainage should be directed away from the top of slopes into swales or other controlled drainage devices. Roof and pavement drainage should be directed into conduits that carry runoff away from the proposed structure.
- 8.4.2 In the case of basement walls or building walls retaining landscaping areas, a waterproofing system should be used on the wall and joints, and a Miradrain drainage panel (or similar) should be placed over the waterproofing. A perforated drainpipe of schedule 40 or better should be installed at the base of the wall below the floor slab and drained to an appropriate discharge area. Accordion-type pipe is not acceptable. The project architect or civil engineer should provide detailed specifications on the plans for all waterproofing and drainage.
- 8.4.3 Underground utilities should be leak free. Utility and irrigation lines should be checked periodically for leaks, and detected leaks should be repaired promptly. Detrimental soil movement could occur if water is allowed to infiltrate the soil for prolonged periods of time.
- 8.4.4 Landscaping planters adjacent to paved areas are not recommended due to the potential for surface or irrigation water to infiltrate the pavement's subgrade and base course. We recommend that area drains to collect excess irrigation water and transmit it to drainage structures or impervious above-grade planter boxes be used. In addition, where landscaping is planned adjacent to the pavement, we recommend construction of a cutoff wall along the edge of the pavement that extends at least 6 inches below the bottom of the base material.
- 8.4.5 If detention basins, bioswales, retention basins, or water infiltration devices are being considered, Geocon Incorporated should be retained to provide recommendations pertaining to the geotechnical aspects of possible impacts and design. Distress may be caused to planned improvements and properties located hydrologically downstream. The distress depends on the amount of water to be detained, its residence time, soil permeability, and other factors. We have not performed a hydrogeology study at the site.

Downstream properties may be subjected to seeps, springs, slope instability, raised groundwater, movement of foundations and slabs, or other impacts as a result of water infiltration.

8.5 Update Geotechnical Reports

- 8.5.1 Update geotechnical reports will be required to continue the development within the neighborhood developments. The update reports should include a review of the proposed grading and development and provide updated recommendations for the design of the project. Additional field investigation or laboratory testing may be required depending on the proposed finish grades. Geocon should be provided with proposed development and grading plans to perform this evaluation and preparation of individual update reports.

8.6 Grading and Foundation Plan Review

- 8.6.1 Geocon Incorporated should review the grading and foundation plans prior to finalization to check their compliance with the recommendations of this report and determine the need for additional comments, recommendations, and/or analysis.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. The firm that performed the geotechnical investigation for the project should be retained to provide testing and observation services during construction to provide continuity of geotechnical interpretation and to check that the recommendations presented for geotechnical aspects of site development are incorporated during site grading, construction of improvements, and excavation of foundations. If another geotechnical firm is selected to perform the testing and observation services during construction operations, that firm should prepare a letter indicating their intent to assume the responsibilities of project geotechnical engineer of record. A copy of the letter should be provided to the regulatory agency for their records. In addition, that firm should provide revised recommendations concerning the geotechnical aspects of the proposed development, or a written acknowledgement of their concurrence with the recommendations presented in our report. They should also perform additional analyses deemed necessary to assume the role of Geotechnical Engineer of Record.
2. The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, Geocon Incorporated should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous or corrosive materials was not part of the scope of services provided by Geocon Incorporated.
3. This report is issued with the understanding that it is the responsibility of the owner or his representative to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.
4. The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.



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GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159

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DSK/GTYPD

VICINITY MAP

OTAY RANCH VILLAGE 2
SPA PLAN AMENDMENT
CHULA VISTA, CALIFORNIA

DATE 02 - 10 - 2014

PROJECT NO. 06862 - 52 - 30

FIG. 1



LIST OF REFERENCES

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2. Cleveland, G. B., 1960, *Geology of the Otay Bentonite Deposit, San Diego County, California*, CDMG Special Report 64.
3. California Geologic Survey (CGS), *Geologic Map of the Jamul Mountains 7.5' Quadrangle, San Diego County, California: A Digital Database, scale 1:24,000*, 2002.
4. California Geological Survey (CGS), *Earthquake Shaking Potential for California, from USGS/CGS Seismic Hazards Model, CSSC No. 03-02*, 2003.
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<http://redirect.conservation.ca.gov/cgs/rghm/pshamap/pshamain.html>
7. Campbell, K. W. and Y. Bozorgnia, *NGA Ground Motion Model for the Geometric Mean Horizontal Component of PGA, PGV, PGD and 5% Damped Linear Elastic Response Spectra for Periods Ranging from 0.01 to 10 s*, Preprint of version submitted for publication in the NGA Special Volume of Earthquake Spectra, Volume 24, Issue 1, pages 139-171, February 2008.
8. Chiou, Brian S.J. and Robert R. Youngs, *A NGA Model for the Average Horizontal Component of Peak Ground Motion and Response Spectra*, preprint for article to be published in NGA Special Edition for Earthquake Spectra, Spring 2008.
9. Geocon Incorporated, *Geotechnical Investigation, Otay Ranch Village 2 East, Heritage Road, and Village 4 Community Park, Chula Vista, California*, dated February 14, 2006 (Project No. 06862-52-02).
10. Geocon Incorporated, *Geotechnical Investigation, Otay Ranch Village 2 West, Chula Vista, California*, dated October 20, 2006 (Project No. 06862-52-09).
11. Geocon Incorporated, *Final Report of Testing and Observation Services Performed During Site Grading, Otay Ranch, Village 2, Heritage Road from Olympic Parkway to Heritage Road Station 87+88, Chula Vista, California*, dated June 18, 2007 (Project No. 06862-52-12).
12. Geocon Incorporated, *Interim Report of Testing and Observation Services Performed During Site Grading, Otay Ranch, Village 2, North, Units 1 and 2, Chula Vista, California*, dated August 28, 2007 (Project No. 06862-52-13).

LIST OF REFERENCES (Concluded)

13. Geocon Incorporated, *Interim Report of Testing and Observation Services Performed During Site Grading, Otay Ranch, Village 2, Phase 1, Chula Vista, California*, dated April 26, 2012 (Project No. 06862-52-02C).
14. Geotechnics Incorporated, *As-Graded Geotechnical Report Olympic Parkway, Stations 131+00 to 184+00, Chula Vista, California*, dated January 4, 2001.
15. Jennings, C. W., *Fault Activity Map of California and Adjacent Areas, California Geologic Data Map Series, Map No. 6*, 1994.
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Website: www.earthquake.usgs.gov/research/hazmaps.
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22. Unpublished reports, aerial photographs and maps on file with Geocon Incorporated.



Project No. 06862-52-30
April 25, 2014

Baldwin & Sons, LLC
610 West Ash Street, Suite 1500
San Diego, California 92101

Attention: Mr. Nick Lee

Subject: LANDSLIDE CONSULTATION
OTAY RANCH VILLAGE 2
CHULA VISTA, CALIFORNIA

- References:
1. *Update Geotechnical Report, Otay Ranch Village 2, SPA Plan Amendment, Chula Vista, California*, prepared by Geocon Incorporated, dated February 10, 2014 (Project No. 06862-52-30).
 2. *Geotechnical Investigation, Otay Ranch Village 2 East, Heritage Road, and Village 4 Community Park, Chula Vista, California*, prepared by Geocon Incorporated, dated February 14, 2006 (Project No. 06862-52-02).
 3. *Geotechnical Investigation, Otay Ranch Village West, Chula Vista, California*, prepared by Geocon Incorporated, dated October 20, 2006 (Project No. 06862-52-09).

Dear Mr. Lee:

In accordance with your request, we prepared this letter regarding the landslides located within the Otay Ranch Village 2 development. The purpose of this letter is to provide additional information regarding the existing landslides in the Otay Ranch Village 2 South and West developments.

We prepared the referenced report dated February 10, 2014 to provide a summary of the existing geotechnical conditions for the Otay Ranch Village 2 development. The report includes a discussion of the existing geologic conditions at the subject site. We performed the referenced geotechnical investigations dated February 14 and October 20, 2006 for the subject property. Based on the referenced reports, 5 landslides exist within the property.

Otay Ranch Village 2 South possesses a landslide in the southwestern portion of the property. The landslide is about 600 feet wide, 400 feet long, and varies from about 16 to 55 feet thick. The slide generally consists of a loose, upper portion of about 10 to 15 feet thick, a loose graben zone, and a medium dense to dense core. This landslide will require removal and replacement of compacted fill during future grading operations where the landslide debris exists below the planned cut area.

Otay Ranch Village 2 West possesses 4 landslides. A landslide is located in the northern portion of the property adjacent to Olympic Parkway that is about 350 feet wide, 300 feet long, and about 50 feet thick. Three landslides are located in the southern-central portion of the development adjacent to the Otay Landfill property. The southwestern landslide is about 650 feet wide, 500 feet long and 50 feet thick. The south-central landslide is about 650 feet wide (in the property), 250 feet long and 50 feet thick. The southeastern landslide is about 900 feet wide (on the property), 550 feet long and 90 feet thick. Two of the landslides appear to extend onto the landfill property. Another landslide was present in the area of Heritage Road but was removed and replaced with compacted fill during the grading operations for the northern portion of Heritage Road within Otay Ranch Village 2 North. The base of the slide masses are typically coincident with a relatively uniform bed of bentonitic claystone that extends beneath the entire site. These landslides generally consist of a loose, upper portion, typically 10 to 15 feet thick, a graben zone of variable thickness typically backfilled with colluvium, a medium dense to dense core zone composed of tightly fractured Otay Formation, and a landslide toe composed of loose debris. The upper portions of the landslide debris are potentially compressible and will require remedial grading in the form of removal and compaction within areas of proposed development. The medium dense to dense landslide core zone of the southeastern two landslide areas is suitable for the support of compacted fill and can be left in-place during remedial grading operations. The southwestern and northern landslides should be removed and replaced with properly compacted fill during future grading operations.

We opine the potential for future landsliding adversely affecting the proposed improvements is low, provided the recommendations for removal and compaction of landslide debris and for stabilization of proposed slopes presented in the referenced reports are implemented.

Should you have any questions regarding this consultation letter, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED


John Hoobs
CEG 1524

JH:SFW:dmc

(e-mail) Addressee




Shawn Foy Weedon
GE 2714

